

1 of 3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

#21  
Fuda  
5/15/02

Appellant: Schwertfeger, Fritz

Group Art Unit: 1762

U.S.S.N.: 09/308,770

Examiner: K. Crockford

Filed: 28 October 1999

Title: METHOD FOR PRODUCING ORGANICALLY MODIFIED,  
PERMANENTLY HYDROPHOBIC AEROGELS



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## APPEAL BRIEF UNDER 37 C.F.R. § 1.192

ASSISTANT COMMISSIONER FOR PATENTS  
BOX PATENT APPEAL BRIEF  
WASHINGTON, D.C. 20231

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Dear Sir:

This brief is filed in furtherance of the Notice of Appeal filed on December 14, 2001, for the above-referenced patent application. Appellant respectfully appeals the decision of Examiner Crockford in the Office Action dated 15 June 2001, finally rejecting claims 1-24, all of the claims in the patent application.

In accordance with 37 C.F.R. § 1.192(a), this brief is being filed in triplicate. Any fees required under 37 C.F.R. § 1.17(c) and any required petition for extension of time for filing this brief and fees therefore, are provided in the accompanying FEE TRANSMITTAL FORM.

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This brief contains the following items, appearing under appropriate headings and in the order listed below:

- I. REAL PARTY IN INTEREST
- II. RELATED APPEALS AND INTERFERENCES
- III. STATUS OF THE CLAIMS
- IV. STATUS OF AMENDMENTS FILED SUBSEQUENT TO FINAL REJECTION
- V. SUMMARY OF THE INVENTION
- VI. ISSUES ON APPEAL
- VII. GROUPING OF THE CLAIMS
- VIII. ARGUMENTS
- IX. CONCLUSION
- X. APPENDIX OF CLAIMS ON APPEAL

**I. REAL PARTY IN INTEREST**

The real party in interest in this appeal is Cabot Corporation, a corporation organized under the laws of the state of Delaware and having its principal place of business in the city of Boston, county of Suffolk, in the Commonwealth of Massachusetts.

**II. RELATED APPEALS AND INTERFERENCES**

There are no other pending appeals or interferences that will directly affect, or be directly affected by, or have bearing on the Board's decision in this appeal.

**III. STATUS OF THE CLAIMS**

Claims 1-19 were originally filed in the patent application. Claims 20-24 were added in the Response to Office Action filed on August 15, 2000. Claim 1-24 are now pending in the application.

Claim 13 has no remaining rejection applied to it, and Appellant requests confirmation that it is in condition for allowance upon being put into independent form or upon allowance of underlying claim 1.

Claims 1-12 and 14-24 stand rejected under 35 U.S.C § 103 and are included in this appeal. The claims on appeal are set forth below in Section X entitled Appendix of Claims on Appeal.

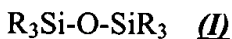
#### **IV. STATUS OF AMENDMENTS FILED SUBSEQUENT TO FINAL REJECTION**

In a Response Pursuant to 37 C.F.R. §1.116 filed on 15 November 2001 in response to the final Office Action mailed on 15 June 2001, Appellant requested entry of an amendment to claim 1. The proposed amendment to claim 1 is shown below in ***italics, bold and underlined*** font.

Claim 1. (Proposed Amendment) A process for the preparation of organically modified aerogels with permanently hydrophobic surface groups, comprising:

- a. introducing a lyogel into a reactor;
- b. washing the lyogel introduced into the reactor in step a) ***essentially free of water*** with an organic solvent;
- c. surface-silylating the lyogel obtained in step b) with a surface-silylating agent to produce a surface-silylated lyogel; and
- d. drying the surface-silylated lyogel obtained in step c) to obtain an aerogel,

wherein the surface-silylating agent in step c) comprises a disiloxane of formula I



wherein the residues R, independently of one another, identically or differently, signify in each case a hydrogen atom or a nonreactive organic

residue that is linear, branched, cyclic, saturated or unsaturated, or aromatic or heteroaromatic.

Appellant also provided arguments in the Response Pursuant to 37 C.F.R. §1.116, traversing the final rejection of claims 1-24. An Advisory Action was mailed on 17 December 2001, in which the Examiner indicated that the proposed amendment to claim 1 had not been entered, because the Examiner believed the proposed amendment raised new issues that would require further consideration and/or search.

Appellant submits, however, that the proposed amendment should have been entered by the Examiner. The semicolon in step c) and the formula reference "(I)" are merely self-evident editorial corrections. In step b) the added text "essentially free of water" is consistent with arguments presented in the course of prosecuting the application. In fact, it is of the same nature as dependent claim 9 calling for the lyogel in step b) to be washed until the water content of the lyogel is  $\leq 5$  wt.%.

Appellant further submits, however, that even without entry of the proposed amendment to claim 1, claim 1 is patentable over the art of record.

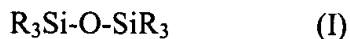
## V. SUMMARY OF THE INVENTION

Lyogel introduced into a reactor is washed with an organic solvent before certain disiloxane silylating agent  $R_3Si-O-SiR_3$  is added to render the solvent-washed lyogel permanently hydrophobic.

More specifically, the claims on appeal define a process for the preparation of permanently hydrophobic aerogels, more specifically, organically modified aerogels with permanently hydrophobic surface groups. (See page 9 of the specification, last full paragraph.) The process for the preparation of such organically modified aerogels with permanently hydrophobic surface groups comprises (a) introducing a lyogel into a reactor; (b) washing the lyogel essentially free of water, with an organic solvent; (c) surface-silylating the lyogel obtained in step b with any of a certain defined group of

surface-silylating agents to produce a surface-silylated lyogel; and (d) drying the surface-silylated lyogel obtained in step c) to obtain the permanently hydrophobic aerogel. (See paragraph bridging pages 9-10 of the specification.)

The surface-silylating agent in step c) comprises a disiloxane of formula I



wherein the residues R, independently of one another, identically or differently, signify in each case a hydrogen atom or a nonreactive organic residue that is linear, branched, cyclic, saturated or unsaturated, or aromatic or heteroaromatic. (Page 9, lines 5-12 of the specification.)

The specification describes the processing complexity and cost disadvantages of using prior known hydrophobing agents, such as methylchlorosilanes and other chlorine-containing silylation agents. (See page 7, last paragraph to page 8, first full paragraph.)

The specification of the present application also describes prior known methods that omit the use of chlorine-containing hydrophobing agents, (see page 8, second full paragraph to page 9, third paragraph), and result in aerogels that are not permanently hydrophobic. In contrast, the present method prepares organically modified aerogels with permanently hydrophobic surface groups.

## **VI. ISSUES ON APPEAL**

The Examiner indicated in the Advisory Action mailed on 17 December 2001, that the rejections based on the Burns et al. patent (US 5,750,610) were overcome because the priority date of the present application precedes the filing date of Burns. In view of the Advisory Action, the issues on Appeal are listed below.

### **Issue 1**

Whether claims 1-2, 9-12, 14-15, 17, 19 and 21-23 are patentable under 35 U.S.C. § 103 over Lentz (US 3,122,520).

**Issue 2**

Whether claims 3-9, 16, 18, 20 and 24 are patentable under 35 U.S.C. § 103 over Lentz in view of Frank et al. (US 5,866,027).

**VII. GROUPING OF THE CLAIMS**

The claims grouped together in the Examiner's rejections do not stand or fall together. Pursuant to 37 CFR Sec. 1.192(7), Appellant explains in the argument section below why the claims of the rejected groups are separately patentable. Accordingly, Appellant has grouped the claims as follows:

<u>Group Number</u>	<u>Claim(s) in Group</u>
<b>Group I</b>	<b>1</b>
<b>Group II</b>	<b>2</b>
<b>Group III</b>	<b>3</b>
<b>Group IV</b>	<b>4</b>
<b>Group V</b>	<b>5</b>
<b>Group VI</b>	<b>6</b>
<b>Group VII</b>	<b>7</b>
<b>Group VIII</b>	<b>8</b>
<b>Group IX</b>	<b>9</b>
<b>Group X</b>	<b>10</b>
<b>Group XI</b>	<b>11</b>
<b>Group XII</b>	<b>12</b>
<b>Group XIV</b>	<b>14</b>
<b>Group XV</b>	<b>15</b>
<b>Group XVI</b>	<b>16</b>
<b>Group XVII</b>	<b>17</b>
<b>Group XVIII</b>	<b>18</b>
<b>Group XIX</b>	<b>19</b>
<b>Group XX</b>	<b>20</b>

Group XXI	21
Group XXII	22
Group XXIII	23
Group XXIV	24

## VIII. ARGUMENTS

### (A) **Issue 1: Claims 1-2, 9-12, 14, 15, 17, 19 and 21-23 are Patentable over Lentz (US 3,122,520)**

Claims 1-2, 9-12, 14, 15, 17, 19 and 21-23 each is patentable over Lentz, because Lentz fails to teach or suggest each and every element of the claim. Nor has anything in Lentz been identified, which would motivate one skilled in the art to modify Lentz in a manner that would yield the present method.

#### Group I

##### **a. Claim 1 is Patentable over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 1**

In the method of claim 1, lyogel introduced into a reactor in step (a) is washed with an organic solvent in step (b) before the defined disiloxane silylating agent is added in step (c). The disiloxane silylating agents  $R_3Si-O-SiR_3$  of the invention are chlorine-free and render the solvent pre-washed lyogel permanently hydrophobic.

In contrast, Lentz never adds such disiloxane silylating agents  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent. Lentz uses certain organosilicon compounds, specifically, certain silanes and siloxanes (see the chemical formula in col. 1 of Lentz), including chlorine-containing organosilicon compounds. The organosilicon compounds of Lentz do not include the disiloxanes of the present invention. For this reason alone the invention of present claim 1 is patentable over Lentz.

Also, Lentz never adds a disiloxane silylating agent  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent, because Lentz does not wash its hydrogel. Rather, Lentz merely admixes solvent and organosilicon compounds into a hydrogel.

That is, water immiscible organic solvent, with or without water miscible solvent, is merely admixed with hydrogel by Lentz along with (in any order) the organosilicon compound. Example 10 is an aberration in Lentz, in that a hydrogel is washed to remove the water, but Lentz does not then use a disiloxane silylating agent  $R_3Si-O-SiR_3$  as required by present claim 1.

Lentz says that its hydrogel can be converted to an organogel by addition of organic solvent, and that the solvent can be added before, after or simultaneous with addition of its organosilicon compounds. Any organic solvent immiscible with water can be employed, according to Lentz, and hexamethyldisiloxane and other disiloxanes are identified as examples of water immiscible organic solvents that are suitable for use as the solvent and serve also as a reactant with the silica hydrogel. But nowhere in Lentz is there any teaching or suggestion that any organic solvent be used to wash Lentz's hydrogel, followed by addition of disiloxane silylating agent  $R_3Si-O-SiR_3$ .

With reference to the proposed clarifying amendment to claim 1, Lentz fails to teach or suggest a process for the preparation of organically modified aerogels with permanently hydrophobic surface groups, in which a lyogel is washed essentially free of water with an organic solvent, followed by silylation with a disiloxane silylating agent  $R_3Si-O-SiR_3$ .

**b. Claim 1 is Patentable Over Lentz because there is  
No Suggestion to Modify Lentz to arrive at the Method of Claim 1**

Claim 1 is patentable over Lentz because there is no suggestion to modify Lentz to arrive at the subject matter of claim 1. Citations cannot properly be modified by speculation, arriving at the claimed invention by using the applicant's own disclosure as a road map to guide the modification.

In this case, Lentz cannot be modified in the manner suggested by the Examiner, because the primary thrust of Lentz is the use of certain defined organosilicon compounds -- silanes and siloxanes -- that do not include the disiloxanes of present claim 1. And, further, nothing in Lentz could suggest to one skilled in the art, that any



improvement is needed or even possible in an aerogel's properties, production costs etc., by washing a precursor hydrogel prior to hydrophobing with a disiloxane.

Accordingly, the rejection of claim 1 is in error and should be reversed.

## **Group II**

### **Claim 2 is Patentable Over Lentz because Lentz fails to Teach or Suggest all the Elements of Claim 2**

Claim 2 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 2 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 2 wherein the lyogel in step (a) is a silicate-type lyogel. The specification of the present application discusses the need for cost efficacy in the production of thermal insulation, etc., and also discusses the cost advantage of producing silica aerogel using acidification of water glass solution etc. The advantages of permanent hydrophobic aerogels are disclosed to be highly applicable to silica aerogels, and most of the exemplification in the specification is of silica gels. Therefore, for these additional reasons, Appellant requests reversal of the rejection of claim 2.

## **Group IX**

### **Claim 9 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 9**

Claim 9, which depends from claim 1, is patentable over Lentz for the reasons stated above in reference to Claim 1, which discussion is incorporated here by reference.

In addition, claim 9 is further patentable over Lentz because Lentz fails to teach or suggest a method wherein the steps recited in claim 1 are performed and lyogel is washed in step (b) until the water content is  $\leq 5$  wt.%. Even if (or, perhaps, especially if) the proposed clarifying amendment to step (b) of claim 1 discussed above ("... washing the lyogel introduced into the reactor in step a) essentially free of water with an organic

solvent ... ") is not entered, claim 9 defines preferred embodiments of the present technology wherein the lyogel is washed in step (b) until the water content is not more than 5 wt.%. Accordingly, Appellant requests reversal of the Examiner and allowance of claim 9.

### **Group X**

#### **Claim 10 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 10**

Claim 10 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 10 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 10 wherein the organic solvent in step b) comprises aliphatic or aromatic hydrocarbon. Washing the hydrogel in step (b) with an organic solvent, prior to silylation, distinguishes the present method over Lentz, and aliphatic and aromatic solvents are expressly disclosed in the present specification for this purpose. (See, e.g., page 17, lower two paragraphs.) Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 10.

### **Group XI**

#### **Claim 11 is Patentable Over Lentz because Lentz fails to Teach or Suggest All Elements of Claim 11**

Claim 11 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 11 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 11, wherein symmetrical disiloxane surface-silylating agent is used in step c) after the lyogel is washed in step (b) with organic solvent. As discussed above, Lentz does not teach or suggest use of symmetrical disiloxane such as hexamethyldisiloxane following washing its hydrogel with an organic solvent but, rather, when used at all, as a solvent and reactant with hydrogel. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 11.

**Group XII****Claim 12 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 12**

Claim 12 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 12 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 12 wherein disiloxane of the formula  $R_3Si-O-SiR_3$  is used in step c) after the lyogel is washed in step (b) with organic solvent, and all of the residues R of the disiloxane are identical. As discussed above, Lentz does not teach or suggest use of disiloxane following washing its hydrogel with an organic solvent but, rather, when used at all, as a solvent and reactant with hydrogel. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 12.

**Group XIV****Claim 14 is Patentable Over Lentz because Lentz expressly Teaches Away from Claim 14 and Lentz Fails to Teach or Suggest All the Elements of Claim 14**

Claim 14 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 14 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 14 wherein surface silylating in step c) is carried out in a solvent following washing the lyogel in step (b) with organic solvent. As discussed above, Lentz does not teach or suggest washing its hydrogel with an organic solvent prior to hydrophobing with a disiloxane. In the Lentz method certain defined silanes and siloxanes (the definition does not cover disiloxanes) are taught for hydrophobing a gel along with an immiscible organic solvent. Disiloxanes in Lentz are used in some examples as the immiscible organic solvent and are said to be in those cases reactant with hydrogel. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 14.

**Group XV****Claim 15 is Patentable Over Lentz because Lentz expressly Teaches Away from the Claim 15 and Lentz Fails to Teach or Suggest All the Elements of Claim 15**

Claim 15 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 15 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 15 wherein surface silylating in step c) is carried out with a disiloxane of formula  $R_3Si-O-SiR_3$  in the presence of a catalyst following washing the lyogel in step (b) with organic solvent. As discussed above, Lentz does not teach or suggest washing its hydrogel with an organic solvent prior to hydrophobing with a disiloxane. In the Lentz method certain defined silanes and siloxanes (the definition does not cover disiloxanes) are taught for hydrophobing a gel along with an immiscible organic solvent. Acid catalysts are disclosed in Lentz, but disiloxanes in Lentz are used as the immiscible organic solvent and in those cases are reactant with hydrogel. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 14.

**Group XVII****Claim 17 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 17**

Claim 17 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 17 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 17 wherein prior to drying in step d) the surface silylated lyogel is washed with protic or aprotic solvent. The present specification (see, e.g., page 19, third full paragraph) discusses such washing prior to drying in step (d) as a preferred embodiment of the invention, for removing unreacted silylation agent. Residual content less than or equal to 1 wt. % of unreacted silylation agent is disclosed. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 14.

**Group XIX****Claim 19 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 19**

Claim 19 depends from claim 1 and is patentable over Lentz for the reasons stated above in reference to claim 1, which discussion is incorporated here by reference.

In addition, claim 19 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 19 wherein, prior to step c), the lyogel is washed with a solution of an orthosilicate capable of bringing about condensation, of formula  $R^1_{4-n}Si-(OR^2)_n$  wherein  $n = 2$  through 4 and  $R^1$  and  $R^2$ , independently of one another, are hydrogen atoms, linear or branched  $C_1$ - $C_4$  alkyl residues, cyclohexyl residues or phenyl residues. As discussed above, Lentz does not teach or suggest washing its hydrogel with an organic solvent prior to hydrophobing with a disiloxane. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 19.

**Group XXI****Claim 21 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 21**

Claim 21 depends from claim 10 and, therefore, indirectly from claim 1, and is patentable over Lentz for the reasons stated above in reference to claims 1 and 10, which discussions are incorporated here by reference.

In addition, claim 21 is further patentable over Lentz because Lentz fails to teach or suggest the method of claim 21 wherein the organic solvent in step b) comprises aliphatic or aromatic hydrocarbon selected from aliphatic alcohols, ethers, esters, and ketones. Washing the hydrogel in step (b) with an organic solvent, prior to silylation, distinguishes the present method over Lentz, and aliphatic and aromatic solvents selected from aliphatic alcohols, ethers, esters, and ketones are expressly disclosed in the present specification for this purpose. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 21.

**Group XXII****Claim 22 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 22**

Claim 22 depends from claim 15, and indirectly from claim 1, and is patentable over Lentz for the reasons stated above in reference to claims 15 and 1, which discussions are incorporated here by reference.

Claim 22 is patentable over Lentz because Lentz fails to teach or suggest the method of claim 22 wherein surface silylating in step c) is carried out with a disiloxane of formula  $R_3Si-O-SiR_3$  in the presence of a catalyst following washing the lyogel in step (b) with organic solvent. As discussed above, Lentz does not teach or suggest washing its hydrogel with an organic solvent prior to hydrophobing with a disiloxane. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 22.

**Group XXIII****Claim 23 is Patentable Over Lentz because Lentz fails to Teach or Suggest All the Elements of Claim 23**

Claim 23 depends from claim 19 and indirectly from claim 1, and is patentable over Lentz for the reasons stated above in reference to claims 1 and 19, which discussions are incorporated here by reference.

In addition, claim 23 is patentable over Lentz because Lentz fails to teach or suggest the method of claim 23 wherein, prior to step c), the lyogel is washed with a solution of an orthosilicate selected from alkyl orthosilicate and aryl orthosilicate capable of bringing about condensation. As discussed above, Lentz does not teach or suggest washing its hydrogel with an organic solvent prior to hydrophobing with a disiloxane. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 19.

In view of the arguments in this Section, claims 1-2, 9-12, 14, 15, 17, 19 and 21-23 are seen to be patentable over Lentz, and Appellant respectfully requests reversal of the subject rejection and allowance of claim 1-2, 9-12, 14, 15, 17, 19 and 21-23.

**(B) Issue 2: Claims 3-9, 16, 18, 20 and 24 are  
Patentable over Lentz in view of Frank et al. (US 5,866,027)**

Claims 3-9, 16, 18, 20 and 24 are patentable over Lentz in view of Frank et al. because the citations fail to disclose all elements of the claims, and the citations are not properly combinable. Lentz is said by the Examiner to be applied in the same manner as recited above in Section (A.) Frank et al. is said by Examiner to disclose adding structural support to a gel through the use of fibers and adding IR turbidity-promoting agents to reduce radiative contribution to thermal conductivity. For the reasons discussed below, the rejection is respectfully traversed.

Frank et al. does not cure the deficiencies of Lentz and, in any event, is not properly combinable with Lentz.

**a. Lentz and Frank et al. are Not Properly Combinable**

It is well established that when determining obviousness, citations must be considered as a whole, and the citations must suggest the desirability of the proposed combination or modification of their disclosure and, thus, the obviousness of the combination. See *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). In addition, the level of skill in the art cannot be relied upon to provide the suggestion to combine citations. See *Al-Site Corp. v. VSI Intl. Inc.*, 174 F.2d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

There is no objective suggestion, either in Lentz or in Frank et al., to combine the references and then modify them to meet the elements of the claims in the present application. Quite the contrary, Frank et al addresses a problem of mechanical stability of a xerogel for insulation purposes, where the xerogels must be usable substantially in

their native form. Frank et al. uses its xerogels in “webs or mats” of fibers (Col.5, lines 30-42) and in thin sheets or stacks of thin sheets (Col. 5, lines 49-55).

In contrast, Lentz is focused on making fillers to be compounded into rubber. Lentz includes a paragraph about other uses but provides no supporting disclosure and exemplifies only use as filler for silicone rubber. There is simply nothing in Lentz that would lead one skilled in the art to seek structural reinforcement of the Lentz aerogels, since this would plainly interfere with their use as powdered filler in rubber. Nothing of record provides the motivation for one skilled in the art to add Frank et al.’s mats of fibers to the Lentz filler aerogels.

Moreover, Frank et al. describes a merely optional solvent exchange prior to hydrophobing. This solves no identified problem in Lentz and does not, of itself, motivate one skilled in the art to modify Lentz. Even if it could be said to make it obvious to try a washing step in Lentz, it is well established that “obvious to try” is no basis for an obvious rejection.

Thus, there is no suggestion or motivation to combine the citations and the rejection should be reversed.

**b. Frank et al. Does Not Cure the deficiencies of Lentz**

Even assuming *arguendo* that any motivation to combine Lentz and Frank et al. could be found in the citations, the combination of Lentz and Frank et al. would not support the obviousness rejection, because their combination does not make the subject matter of the claims obvious as a whole.

Frank et al., as mentioned above, describes a merely optional solvent exchange prior to hydrophobing. And Frank et al does not disclose or suggest use of the present disiloxanes  $R_3Si-O-SiR_3$  to silylate a lyogel. Rather, the only time Frank et al discuss specific silylating agents, it expressly teaches away from the use of the present disiloxanes  $R_3Si-O-SiR_3$ , pointing instead to chlorinated compounds and other non-disiloxane compounds (Col. 3, lines 59-64):



“Preference is given to using silylating agents of the formula  $R'_{4-n}SiCl_n$  or  $R'_{4-n}Si(OR')_n$  ... Silazanes are also suitable. Preference is given to using methyltrichlorosilane, dimethyltrichlorosilane, trimethylchlorosilane, trimethylmethoxysilane or hexamethyldisilazane.”

Accordingly, since, neither Frank et al nor Lentz teaches or suggests treating a lyogel with a the present disiloxanes  $R_3Si-O-SiR_3$  after the lyogel has been washed with organic solvent, and since there is no identified problem in either citation addressed by such modification of their disclosure, the combination of Lentz and Frank et al fails to support the rejection.

### **Group III**

Claim 3 depends from claim 2 and indirectly from claim 1 and is patentable over the citations because Lentz does not add the present disiloxane silylating agent  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent. The arguments above supporting patentability of claim 1 are incorporated here by reference. And Lentz fails to teach or suggest such method wherein the lyogel in step (a) is a silicate-type lyogel obtainable by hydrolysis and condensation of Si alkyloxides in an organic solvent with water. The specification of the present application discusses the need for cost efficacy in the production of thermal insulation, etc., and expressly discloses lyogels obtainable by hydrolysis and condensation of Si alkyloxides in an organic solvent with water.

Frank et al. fails to cure these deficiencies of Lentz, as discussed above. For these additional reasons, Appellant requests reversal of the rejection of claim 3.

### **Group IV**

Claim 4 depends from claim 2 and indirectly from claim 1 and is patentable over the citations because Lentz does not add the present disiloxane silylating agent  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent. The arguments above supporting patentability of claim 1 are incorporated here by reference. And Lentz fails to

teach or suggest such method wherein the lyogel in step (a) is a silicate-type hydrogel prepared by bringing an aqueous water glass solution to a pH value  $\leq 3$  with the aid of an acidic ion-exchanged resin or an inorganic acid to produce silicic acid and, via the addition of a base, polycondensing the silicic acid to give a  $\text{SiO}_2$  gel. The specification of the present application discusses the need for cost efficacy in the production of thermal insulation, etc., and expressly discloses lyogels prepared by bringing an aqueous water glass solution to a pH value  $\leq 3$  with the aid of an acidic ion-exchanged resin or an inorganic acid to produce silicic acid and, via the addition of a base, polycondensing the silicic acid to give a  $\text{SiO}_2$  gel.

Frank et al. fails to cure these deficiencies of Lentz, as discussed above. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 4.

#### **Group V**

Claim 5 depends from claim 2 and indirectly from claim 1 and is patentable over the citations because Lentz does not add the present disiloxane silylating agent  $\text{R}_3\text{Si-O-SiR}_3$  to a lyogel that has first been washed with an organic solvent. The arguments above supporting patentability of claim 1 are incorporated here by reference. And Lentz fails to teach or suggest such method wherein the lyogel in step (a) is a silicate-type gel prepared from an aqueous water glass solution with the aid of at least one organic or inorganic acid via the intermediate stage of silicic acid sol. The specification of the present application discusses the need for cost efficacy in the production of thermal insulation, etc., and expressly discloses lyogels prepared from an aqueous water glass solution with the aid of at least one organic or inorganic acid via the intermediate stage of silicic acid sol.

Frank et al. fails to cure these deficiencies of Lentz, as discussed above. Accordingly, for these additional reasons, Appellant requests reversal of the rejection of claim 4.

#### **Group VI**

Claim 6 depends from any one of claims 1 through 5 and is patentable over the citations because Lentz does not add the present disiloxane silylating agent  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent. The arguments above supporting patentability of claim 1 are incorporated here by reference. And Lentz fails to teach or suggest such method characterized by addition of IR turbidity-promoting agents. Frank et al. fails to cure these deficiencies of Lentz, as discussed above, and Appellant requests reversal of the rejection of claim 6.

### **Group VII**

Claim 7 depends from any one of claims 1 through 5 and is patentable over the citations because Lentz does not add the present disiloxane silylating agent  $R_3Si-O-SiR_3$  to a lyogel that has first been washed with an organic solvent. The arguments above supporting patentability of claim 1 are incorporated here by reference. And Lentz fails to teach or suggest such method characterized by addition of fibers. Frank et al. fails to cure these deficiencies of Lentz, as discussed above, and Appellant requests reversal of the rejection of claim 7.

### **Group VIII**

Claim 8 depends from claim 1 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 1 wherein the lyogel obtained in step a) is aged before it is washed in step b) and then silylated by disiloxane. The further arguments above supporting patentability of claim 1 are incorporated here by reference.

Accordingly, Appellant requests reversal of the rejection of claim 8.

### **Group IX**

Claim 9 depends from claim 1 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 1 wherein the lyogel in step b) is washed until the water content of the lyogel is  $\leq 5$  wt.%. The further arguments above supporting patentability of claims 1 and 9 are incorporated

here by reference. Accordingly, claim 9 is patentable over the citations, and Appellant respectfully requests withdrawal of the rejection and allowance of claim 9.

#### **Group XVI**

Claim 16 depends from claim 1 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 1 wherein the surface-silylating agent in step c) is carried out in the presence of catalytic quantities of trimethylchlorosilane. The further arguments above supporting patentability of claim 1 are incorporated here by reference. Accordingly, Appellant requests reversal of the rejection of claim 16.

#### **Group XVIII**

Claim 18 depends from claim 1 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 1 wherein step d) comprises subcritically drying the surface-silylated lyogel. The further arguments above supporting patentability of claim 1 are incorporated here by reference. Accordingly, Appellant requests reversal of the rejection and allowance of claim 18.

#### **Group XX**

Claim 20 depends from claim 4 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 4 wherein an inorganic acid is used to bring the aqueous water glass solution to a pH value of  $\leq 3$ , and the lyogel is washed essentially free from electrolytes with water. The further arguments above supporting patentability of claim 1 are incorporated here by reference. Accordingly, Appellant requests reversal of the rejection and allowance of claim 20.

#### **Group XXIV**

Claim 24 depends from claim 1 and is patentable over the citations because Lentz in view of Frank et al. fails to teach or suggest a process in accordance with claim 1 wherein, prior to step c), the lyogel is washed with aqueous silicic acid solution. The

further arguments above supporting patentability of claim 1 are incorporated here by reference. Accordingly, Appellant requests reversal of the rejection and allowance of claim 24.

In view of the arguments in this Section, each of claims 3-9, 16, 18, 20 and 24 is patentable over Lentz in view of Frank et al. Appellant respectfully requests a finding of allowability of claim 3-9, 16, 18, 20 and 24.

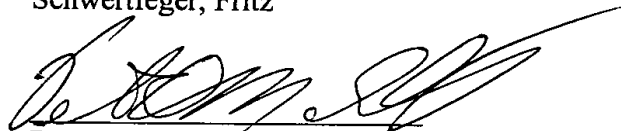
### IX. CONCLUSION

For the reasons stated above, each of claims 1-24 is patentable over the citations of record. Appellant respectfully requests reversal of the Examiner's rejection of the claims, and allowance of all claims.

Date

9 May 2002

Respectfully submitted,  
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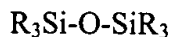
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**IX. APPENDIX OF CLAIMS ON APPEAL**

Claim 1. A process for the preparation of organically modified aerogels with permanently hydrophobic surface groups, comprising:

- a. introducing a lyogel into a reactor;
- b. washing the lyogel introduced into the reactor in step a) with an organic solvent;
- c. surface-silylating the lyogel obtained in step b) with a surface-silylating agent to produce a surface-silylated lyogel and
- d. drying the surface-silylated lyogel obtained in step c) to obtain an aerogel,

wherein the surface-silylating agent in step c) comprises a disiloxane of formula I



wherein the residues R, independently of one another, identically or differently, signify in each case a hydrogen atom or a nonreactive organic residue that is linear, branched, cyclic, saturated or unsaturated, or aromatic or heteroaromatic.

Claim 2. A process in accordance with claim 1 wherein step a) comprises introducing a silicate-type lyogel into the reactor.

Claim 3. A process in accordance with claim 2 wherein step a) comprises introducing into the reactor a silicate-type lyogel which is obtainable by hydrolysis and condensation of Si alkyl oxides in an organic solvent with water.

Claim 4. A process in accordance with claim 2 wherein step a) comprises introducing into the reactor a silicate-type hydrogel prepared by bringing an aqueous water glass solution to a pH value  $\leq 3$  with the aid of an acidic ion-exchanged resin or an inorganic

acid to produce silicic acid and, via the addition of a base, polycondensing the silicic acid to give a SiO<sub>2</sub> gel.

Claim 5. A process in accordance with claim 2, wherein in step a) a silicate type gel is introduced into the reactor, the silicate-type gel being prepared from an aqueous water glass solution with the aid of at least one organic or inorganic acid via the intermediate stage of silicic acid sol.

Claim 6. A process in accordance with one of claims 1 through 5, characterized by addition of IR turbidity-promoting agents.

Claim 7. A process in accordance with one of claims 1 through 5, characterized by addition of fibers.

Claim 8. A process in accordance with claim 1 wherein the lyogel obtained in step a) is aged before it is washed in step b).

Claim 9. A process in accordance with claim 1 wherein the lyogel in step b) is washed until the water content of the lyogel is  $\leq 5$  wt.%.

Claim 10. A process in accordance with claim 1 wherein the organic solvent in step b) comprises aliphatic or aromatic hydrocarbon.

Claim 11. A process in accordance with claim 1 wherein the surface-silylating agent in step c) comprises symmetrical disiloxane.

Claim 12. A process in accordance with claim 1 wherein all the residues R in the disiloxane are identical.

Claim 13. A process in accordance with claim 1 wherein the surface-silylating agent in step c) is hexamethyldisiloxane.

Claim 14. A process in accordance with claim 1 wherein the surface-silylating agent in step c) is carried out in a solvent.

Claim 15. A process in accordance with claim 1 wherein the surface-silylating agent in step c) is carried out in the presence of a catalyst.

Claim 16. A process in accordance with claim 1 wherein the surface-silylating agent in step c) is carried out in the presence of catalytic quantities of trimethylchlorosilane.

Claim 17. A process in accordance with claim 1 wherein prior to step d), the surface-silylated lyogel is washed with a protic or aprotic solvent.

Claim 18. A process in accordance with claim 1 wherein step d) comprises subcritically drying the surface-silylated lyogel.

Claim 19. A process in accordance with claim 1 wherein, prior to step c), the lyogel is washed with a solution of an orthosilicate capable of bringing about condensation, of formula  $R^1_{4-n}Si-(OR^2)_n$  wherein  $n = 2$  through  $4$  and  $R^1$  and  $R^2$ , independently of one another, are hydrogen atoms, linear or branched  $C_1$ - $C_4$  alkyl residues, cyclohexyl residues or phenyl residues.

Claim 20. A process in accordance with claim 4 wherein an inorganic acid is used to bring the aqueous water glass solution to a pH value of  $\leq 3$ , and the lyogel is washed essentially free from electrolytes with water.



Claim 21. A process in accordance with claim 10 wherein the organic solvent in step b) is selected from aliphatic alcohols, ethers, esters, and ketones.

Claim 22. A process in accordance with claim 15 wherein the catalyst comprises an acid.

Claim 23. A process in accordance with claim 19 wherein the orthosilicate is selected from alkyl orthosilicate and aryl orthosilicate.

Claim 24. A process in accordance with claim 1 wherein, prior to step c), the lyogel is washed with aqueous silicic acid solution.